450.1 DESCRIPTION

This work consists of furnishing and installing polyethylene pipe, concrete and metal pipe, storm drains, and cattle passes excluding structural metal plate culverts.

450.2 MATERIALS

Materials shall conform to the following Sections:

A. Reinforced Concrete Pipe: Section 990.

B. Corrugated Metal Pipe: Section 990.

C. Corrugated Polyethylene Pipe: Section 990.

D. Flexible Watertight Gaskets: Section 990.

E. Drainage Fabric: Section 831.1 - Type A.

450.3 CONSTRUCTION REQUIREMENTS

A. Concrete Pipe Culvert: Concrete pipe culverts shall be laid with the groove or bell end of the pipe upstream and inserting the tongue end into the groove. Except where flexible watertight gaskets are used, each joint shall be effectively protected against infiltration of backfill soil by filling the joint space with an approved sealer or by providing a full circumferential wrap with a one foot (300 mm) wide strip of drainage fabric around the perimeter of the pipe. The drainage fabric shall be centered over the joint. The Engineer shall require the use of construction adhesives if the Contractors method of installation doesn't secure the drainage fabric over the center of the joint while placing backfill. A combination of sealer and drainage fabric materials will be allowed.

Lift holes shall be covered or plugged to prevent backfill from entering the pipe.

When the plans require the use of rubber gaskets at joints they shall be installed according to manufacturer instructions.

B. Corrugated Metal Pipe Culverts: Corrugated metal pipe culverts shall be laid with outside laps of circumferential joints pointing upstream and with the longitudinal laps on the sides. The ends of the pipe sections shall be approximately one inch (25 mm) apart to enable corrugations of the bands to mesh with the corrugations of the pipe.

C. Corrugated Polyethylene Pipe Culverts: Corrugated polyethylene pipe culverts shall be installed according to manufacturer instructions.

D. General: Multiple lines of pipe culverts shall be accurately laid in parallel lines in all planes.

The amount of camber shall depend on the height of fill and nature of the supporting soil.

Equipment capable of gently lowering the sections of pipe into place shall be provided. Dropping the pipe into place will not be permitted.

E. Excavation: Trenches shall be excavated to a width that allows for proper jointing of the pipe and compaction of the bedding and backfill material under and around the pipe. Where feasible, trench walls shall be vertical.

The trench bottom shall be compacted in accordance with Section 421.3.C for its full length and width.

The foundation for each type of bedding shall provide a uniform stable support. Removal of unstable material or rock below bedding grade shall be performed as set forth in Section 421.

F. Bedding: A flat bed shall be provided for cattle passes.

The pipe bedding shall conform to one of the specified classes described below. When no bedding class is specified, the requirement for class C bedding shall apply.

1. **Class A Bedding:** This bedding shall consist of a continuous concrete cradle conforming to the plan details.

2. **Class B Bedding (Ring Compression Design):** Material shall be excavated to a depth of 12 inches (300 mm) below the bottom of the pipe grade and to a width equal to the external diameter of the pipe plus one foot (300 mm). The excavated area shall be backfilled with select fill material to form a bed that is at least 15 percent of the pipe height above the lower face (invert) of the pipe. The material shall be thoroughly compacted to provide a firm uniform foundation. The foundation shall then be shaped (cradled) to fit the lower part of the pipe, and the pipe shall be laid on a three inch (75 mm) thick layer of suitable granular material. The Contractor shall ensure that the cradle is constructed at an elevation such that after placing the three inches (75 mm) of granular material in the cradle, the flowline elevation of the pipe is correct. Select fill material shall then be placed in 6 inch (150 mm) layers and compacted with mechanical tampers, to at least 30 percent of the overall pipe height.

   When the pipe foundation is entirely in new embankment constructed with select fill material, the 12 inch (300 mm) undercut will be waived.

3. **Class C Bedding:** This bedding shall consist of an earth or granular cradle of uniform density shaped to fit the lower part of the pipe for at least 10 percent of its overall height.

G. Backfill Above Bedding Grade: Backfilling shall conform to the requirements for normal type backfill or imperfect trench backfill. When backfilling requirements are not specified, the requirements for normal type backfill will apply. Moisture and density requirements for backfill shall be as specified in the plans and shall meet the requirements of Section 120. The backfill material shall be pre-moistened if necessary to obtain uniform moisture.

1. **Normal Type Backfill:** Selected embankment material shall be placed along the pipe in layers not exceeding six inches (150 mm) in depth and thoroughly compacted by mechanical compactors to the specified density before successive layers are placed. The width of the berms on each side of the pipe shall be twice as wide as the external diameter of the pipe or 12 feet (four meters), whichever is less. This method of backfilling shall be continued until the embankment is at least two feet (600 mm) over the top of the pipe.

   In trench installations, backfill width shall be equal to trench width. The backfill shall be brought up evenly on both sides of the pipe for its full length. This method of backfilling shall be continued until the embankment is at least two feet (600 mm) over the top of the pipe.

2. **Imperfect Trench Backfill (Concrete Pipe Only):**The imperfect trench is constructed after the embankment or a portion of the embankment has been constructed.

   The pipe is installed, backfilled, and compacted by normal construction methods. Construct the fill to an elevation of at least one outside pipe diameter plus one foot (300 mm) over the top of the pipe. The normal embankment material shall be compacted to 95 percent of the maximum dry density determined by SD 104(AASHTO T-99). Compact on each side of the pipe for a lateral distance equal to twice the outside pipe diameter or 12 feet (3.6 m), whichever is less. Excavate a vertical trench in the compacted fill directly over the pipe down to within one foot of the top of the pipe. The width of the trench shall not be less than one outside pipe diameter nor greater than one outside pipe diameter plus 8 inches (200 mm).

   Refill the trench with loose straw or sawdust to a depth of one outside pipe diameter. The straw and sawdust shall be reasonably dry and not decomposed or moldy. Other material shall not be substituted for imperfect trench backfill. Complete the remainder of the embankment from the top of the imperfect trench with normal fill material and by normal embankment construction methods.

H. Replacing Disturbed Surfacing Material: If the pipe culvert installation requires the removal or disturbing of surfacing material and no items or quantities for replacement surfacing are provided, disturbed surfacing shall be satisfactorily replaced at no additional cost to the State.

450.4 METHOD OF MEASUREMENT

A. Furnishing and Installing Pipe Culverts: Furnishing and installing pipe culverts will be measured by the foot (0.1 meter) of the respective types, classes, and sizes. The length will be obtained by multiplying the nominal length of the sections by the number of sections used.

When an installation requires that a section of pipe be cut, such as storm sewer installations, the length will be the actual length required, rounded up to the nearest even two feet (0.5 meter).

B. Furnishing and Installing End Sections: Furnishing and installing end sections for the respective type and sizes of pipe culverts will be measured by the number of complete end sections furnished and installed.

C. Replacing Disturbed Surfacing Material: Measurement will not be made for this item.

450.5 BASIS OF PAYMENT

A. Furnishing Pipe Culverts: Furnishing pipe culverts will be paid for at the contract unit price per foot (0.1 meter) for the types, classes, and sizes furnished and accepted. The Contractor may substitute a higher class of pipe than specified at their own expense.

Payment will be full compensation for furnishing the pipe, special sections, gaskets, connecting devices and, coupling bands and for elongation, when specified.

B. Furnishing End Sections: Furnishing end sections will be paid for at the contract unit price per each for the type and size furnished and accepted.

C. Installing Pipe Culverts: Installing pipe culverts will be paid for at the contract unit price per foot (0.1 meter) for the types, classes and sizes accepted.

Payment will be full compensation for installing the pipe culverts, special sections, gaskets, drainage fabric, construction adhesive, preformed mastic, connecting devices, and coupling bands. Payment will also be full compensation for necessary bedding operations, cost of selecting and placing backfill, furnishing and installing required granular or other bedding materials, necessary excavation, and labor, equipment and all incidentals required.

Authorized excavation of material below the pipe foundation will be paid for as specified in Section 421.5.

D. Installing End Sections: Installing end sections will be paid for at the contract unit price per each for the type and size accepted.

E. Replacing Disturbed Surfacing Material: Separate payment will not be made. The cost of replacement shall be incidental to the pipe installed.